

UNCLASSIFIED

AD 405 836

DEFENSE DOCUMENTATION CENTER

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

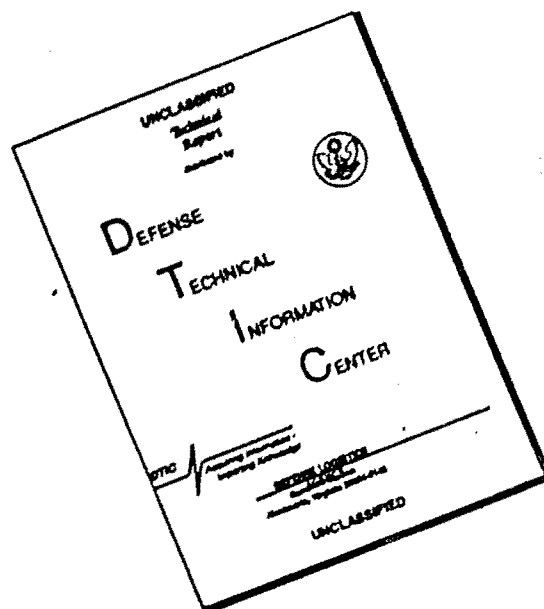
CAMERON STATION, ALEXANDRIA, VIRGINIA



UNCLASSIFIED

NOTICE: When government or other drawings, specifications or other data are used for any purpose other than in connection with a definitely related government procurement operation, the U. S. Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

405836

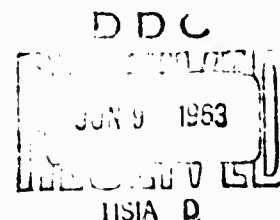
63-3-5

USNRDL-TR-633
5 March 1963

ESTIMATED TOTAL CHAIN AND
INDEPENDENT FISSION YIELDS FOR
SEVERAL NEUTRON-INDUCED FISSION PROCESSES

by
L. E. Weaver
P. O. Strom
P. A. Killeen

405836



U.S. NAVAL RADIOLOGICAL
DEFENSE LABORATORY
SAN FRANCISCO 24, CALIFORNIA

NUCLEAR CHEMISTRY BRANCH
N. E. Ballou, Head

CHEMICAL TECHNOLOGY DIVISION
L. H. Gevantman, Head

ADMINISTRATIVE INFORMATION

The work reported is part of a project sponsored by the Atomic Energy Commission, under Contract Number AT (49-7)-1963. The project is described in USNRDL Technical Program Summary For Fiscal Years 1963, 1964, and 1965, 1 November 1962, where it is designated Program A-1, Problem 7.

Eugene P. Cooper
Eugene P. Cooper
Scientific Director

E. B. Roth
E. B. Roth, CAPT USN
Commanding Officer and Director

ABSTRACT

Calculated estimates are presented of unmeasured total chain yields and of independent fission yields for the fission products resulting from fission-spectrum and 14-Mev neutron bombardment of U^{233} , U^{235} , U^{238} and Pu^{239} and from thermal neutron bombardment of U^{233} , U^{235} and Pu^{239} .

SUMMARY

The Problem

Calculations of fission product growth and decay at early times after fission require input data, much of which has not been obtained and must be estimated.

Findings

This report presents estimates of total chain and independent fission yields resulting from a number of fission reactions based upon (1) observed or assumed chain yield distributions, (2) the nuclear charge for β stability as a function of mass number, (3) the values of the most probable charge in fission as a function of mass number and (4) the distribution of nuclear charge about the most probable value.

INTRODUCTION

The initial development of a generalized fallout model has been planned to yield early, if approximate land surface burst prediction capability. It was intended to refine the input data and to extend the model to other burst conditions. However, the sensitivity of radionuclide fractionation to the independent yields and half-lives of the primary fission products, the timely appearance of up-to-date treatments bearing upon the subject,^{1,2} have led to the revision of the nuclear input data as early as possible.

This report consists of the tabulation of estimated total chain yields and independent yields for fission products resulting from the fission of U²³³, U²³⁵, Pu²³⁹ caused by thermal neutrons and of U²³³, U²³⁵, U²³⁸, and Pu²³⁹ by fission spectrum neutrons and neutrons of 14-Mev energy. These estimates while somewhat preliminary will be useful to this program as well as to many engaged in radionuclide build-up and decay calculations for programs in other areas, e.g., reactor chemistry and physics, radiobiology and operations analysis.

METHOD OF CALCULATION

The data required for determining these values were: Y_A , the fission yields in percent of each mass number A for the particular fission reaction involved, and f_Z , the fractional chain yields for each isobar of mass A for the particular fission reaction involved. The quantities of atoms reported are those resulting from the arbitrary choice of 10^4 fissions occurring simultaneously. Therefore the number of atoms of atomic number Z and mass A resulting from 10^4 simultaneous fissions is:

$$(f_Z) \left(\frac{Y_A}{100} \right) (10^4)$$

for the particular reaction involved.

Total Chain Yields

The values for the total chain yields, Y_A , were those given by Katcoff's compilation.¹ In regions of incomplete data, yields were taken from fission yield curves constructed on the basis of available data and estimates of the amount of variation in chain yields induced by given changes in neutron energy and in mass number of the fissioning nuclide. In each case the total fissions were normalized to 200 %. The resulting curves, in units of percent, are shown graphically in Figs. 1 through 11 and additional details of estimation, when necessary, accompany each figure. The data are presented in Table 1 in units of atoms per 10^4 fissions.

Fractional Chain Yields

The fractional chain yields, AfZ , or fraction of the total chain yield of mass A bearing charge Z, were determined for each value of Z in the mass chain A, in the region of the most probable charge in fission, Z_p , for that mass number. The values for Z_p for thermal neutron fission of U^{235} were taken from Coryell.² Unique values are not given, however, for Z_p in the neighborhood of shell and sub-shell closures and their conjugates ($A = 68-71, 82-84, 98-100, 105-106, 128-130, 134-135, 149-152, 163-164$, inclusive). In these cases values of Z_p were taken from a constructed linear plot connecting the extremal points of the regions of double values of Z_p . From the values so obtained for Z_p , together with Glendenin's charge dispersion curve,² the values for fractional chain yield AfZ , were found for each mass number A.

The change in Z_p , relative to that obtained in the thermal neutron fission of U^{235} , due to other fissile material and neutron energies was found through the use of Coryell's prescription²

$$\Delta Z_p(A) = \frac{1}{2} (Z_c - 92) - 0.21 (A_c - 236) + (0.023) (E^* - 6.5)$$

where $\Delta Z_p(A) = Z_p^*(A) - Z_p(A)$ (standard), $Z_p^*(A)$ being the value sought for given fission conditions and $Z_p(A)$ (standard) being the value of Z_p of mass chain A for thermal neutron fission of U^{235} ; and Z_c is the charge, A_c the mass, and E^* the excitation energy (in Mev) of the compound nucleus under consideration. In this manner values of the most probable charge for mass numbers found in fission for all of the cases considered were calculated.

From the above calculations and data, the number of atoms of given Z and A were calculated on the basis of 10^4 simultaneous fissions having occurred under the various conditions enumerated. The results of these calculations are given in Table 1.

Figures 1 to 11. Fission Yield Curves for Reactions
From Various Neutrons
(Fission = Fission Spectrum; Th = Thermal)

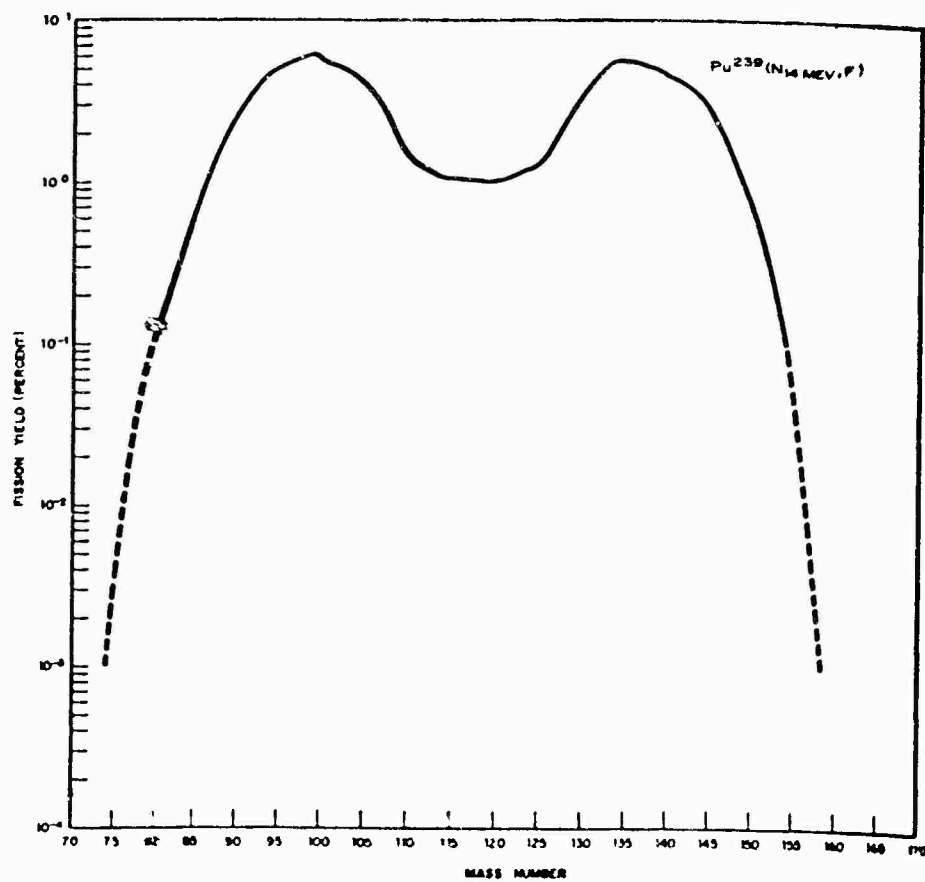


Fig. 1

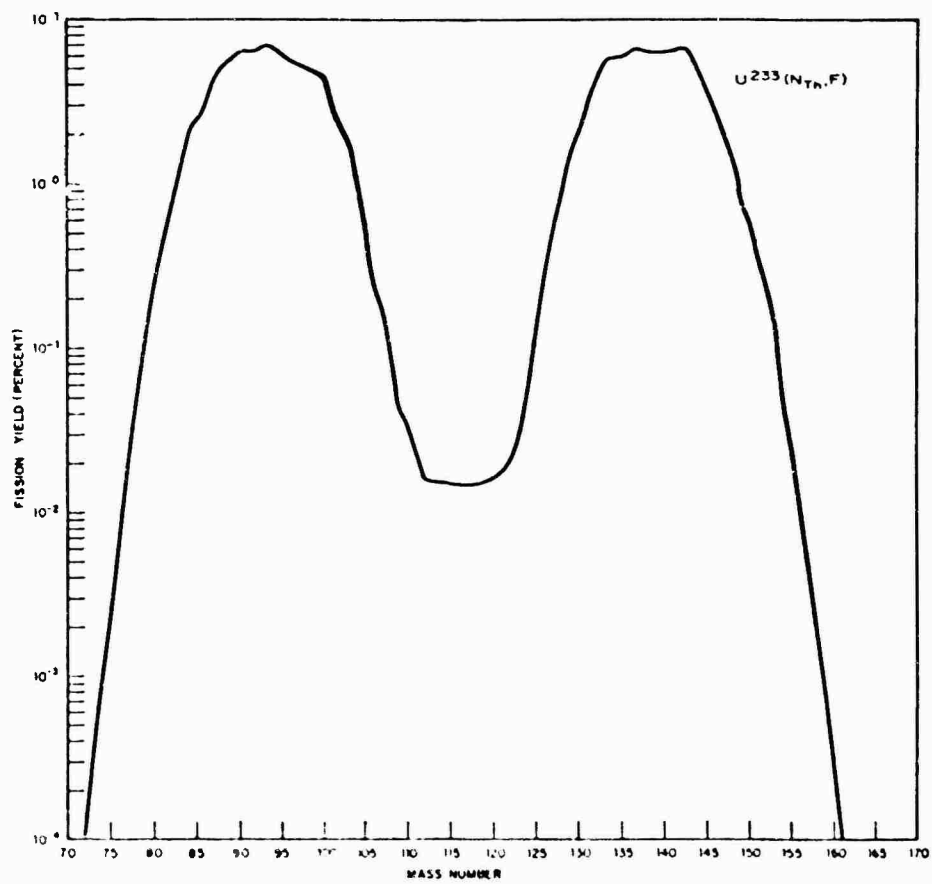


Fig. 2

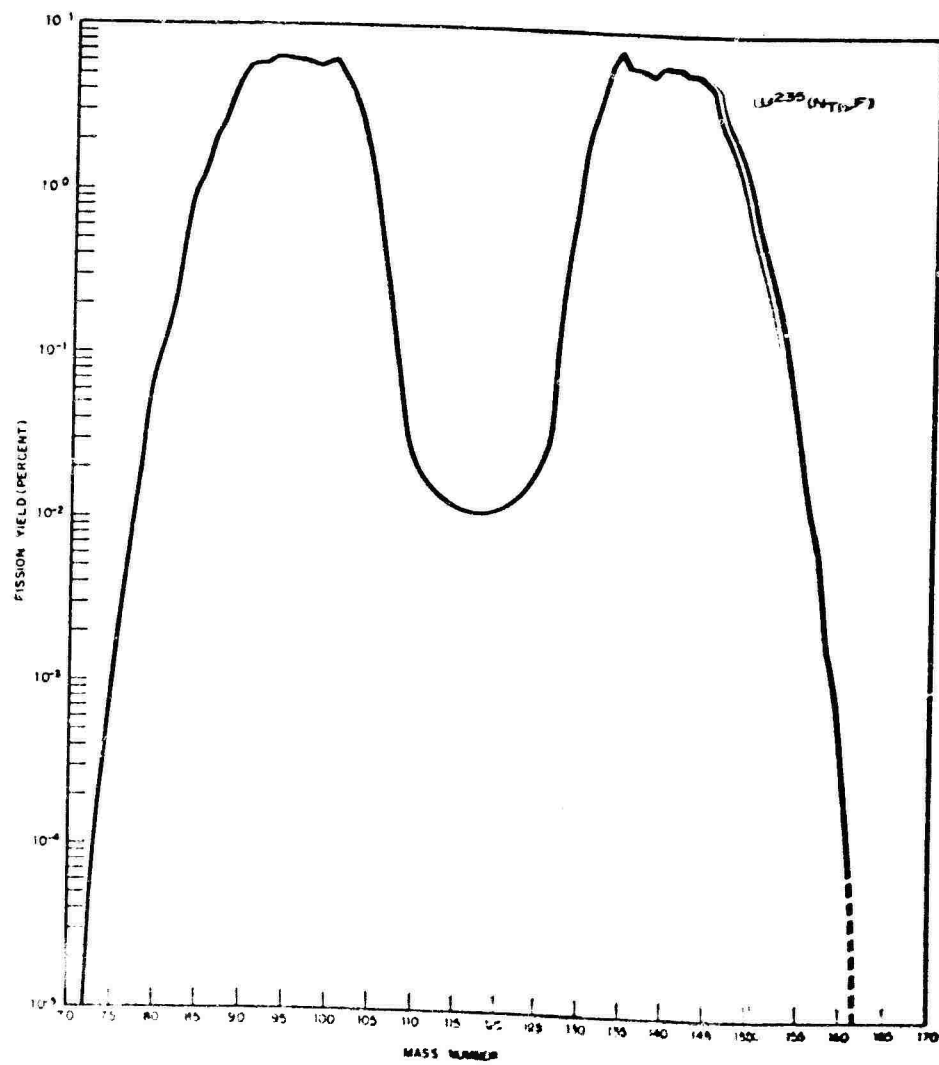


Fig. 3

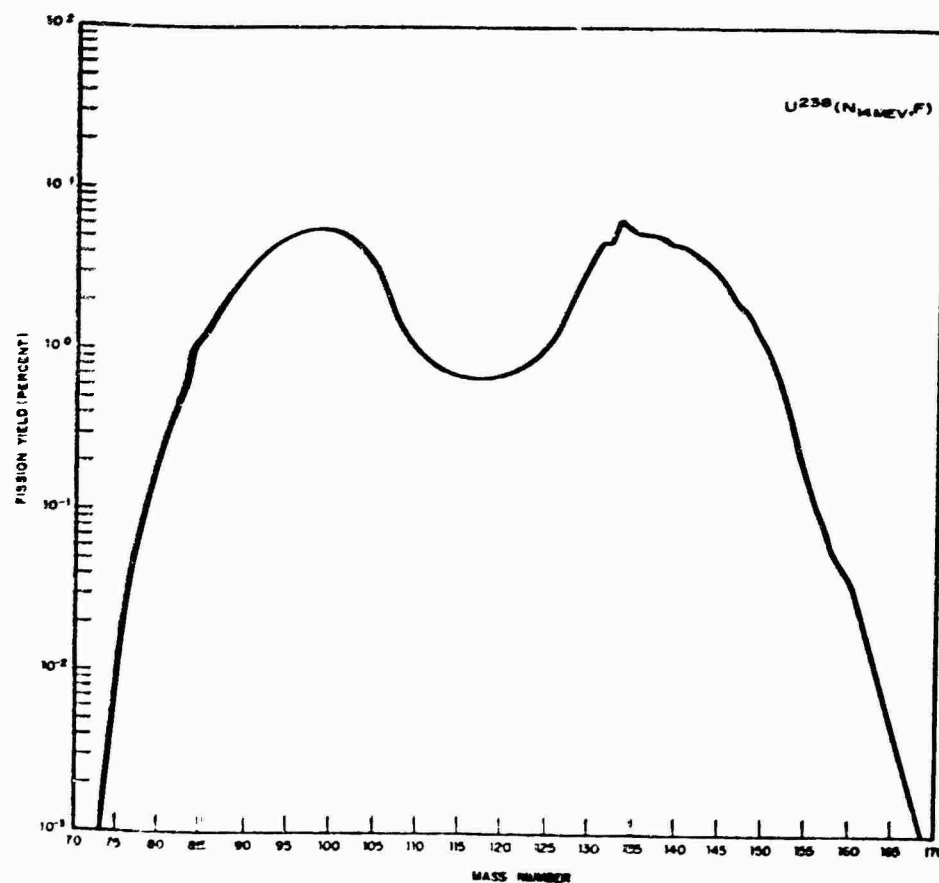


Fig. 4

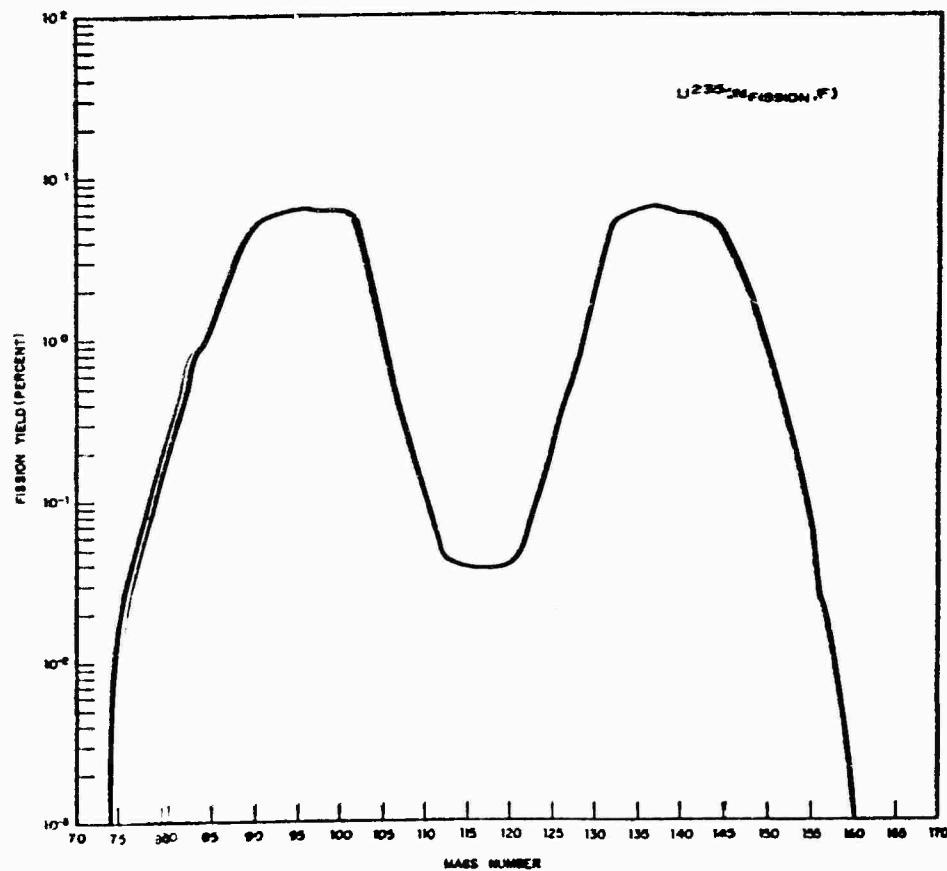


Fig. 5

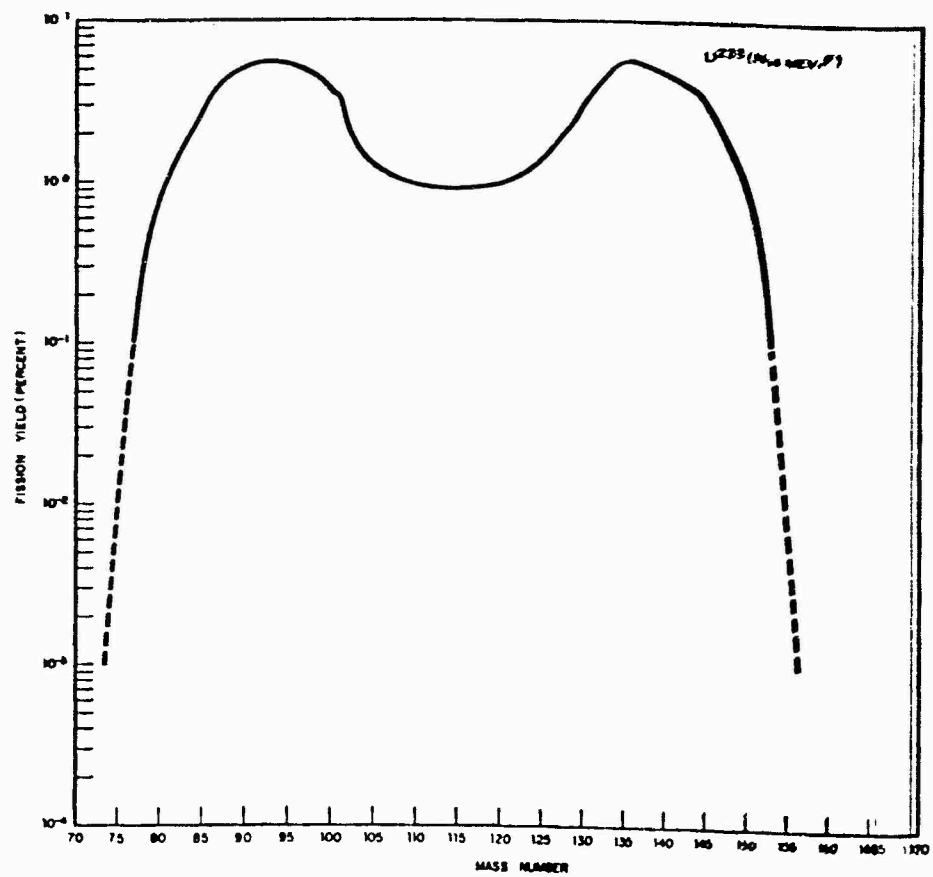


Fig. 6

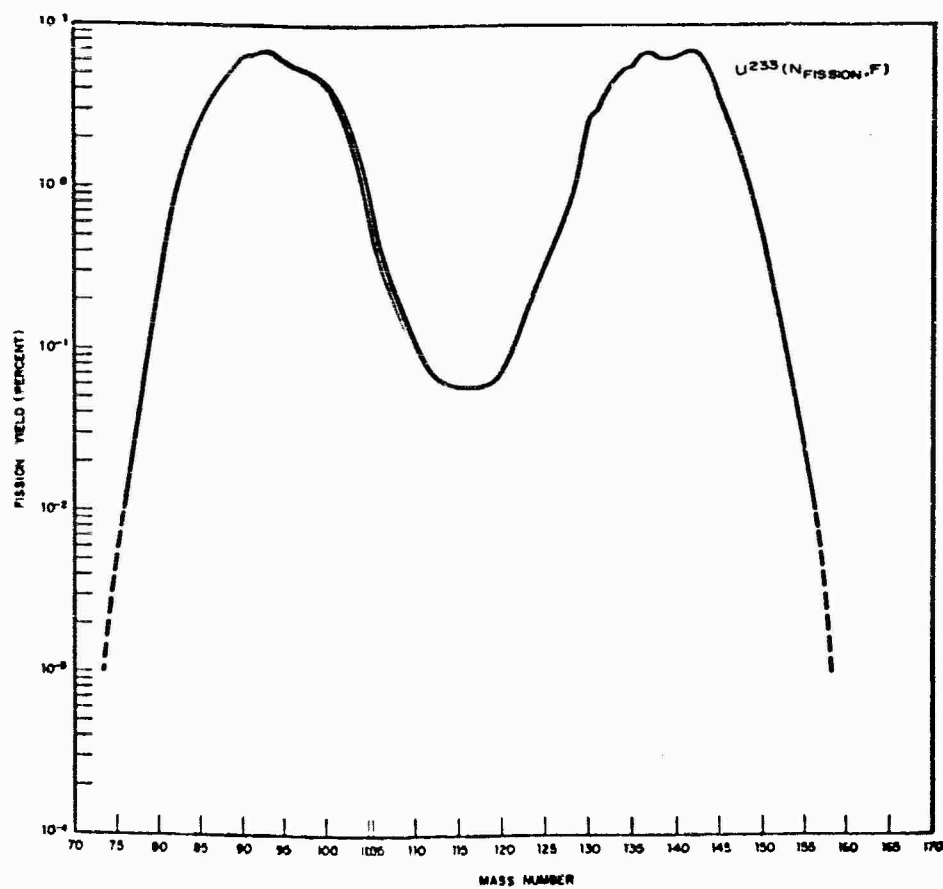


Fig. 7

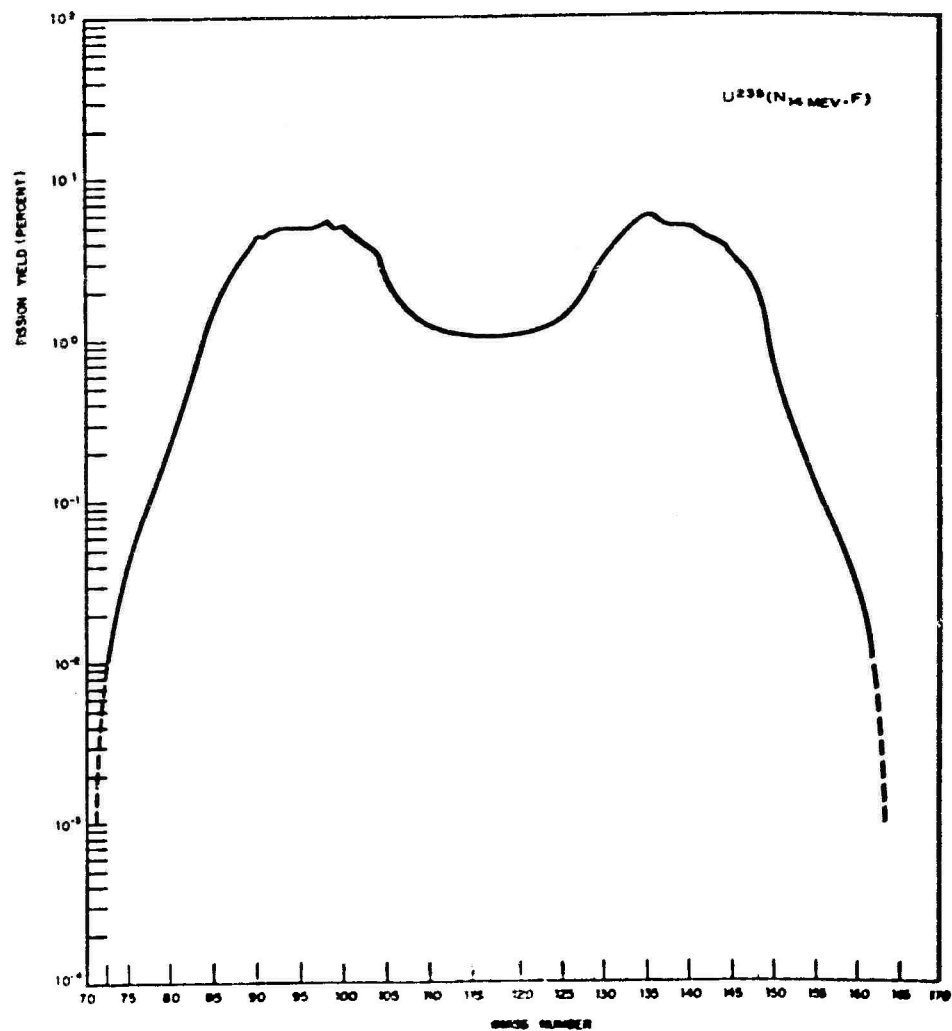


Fig. 8

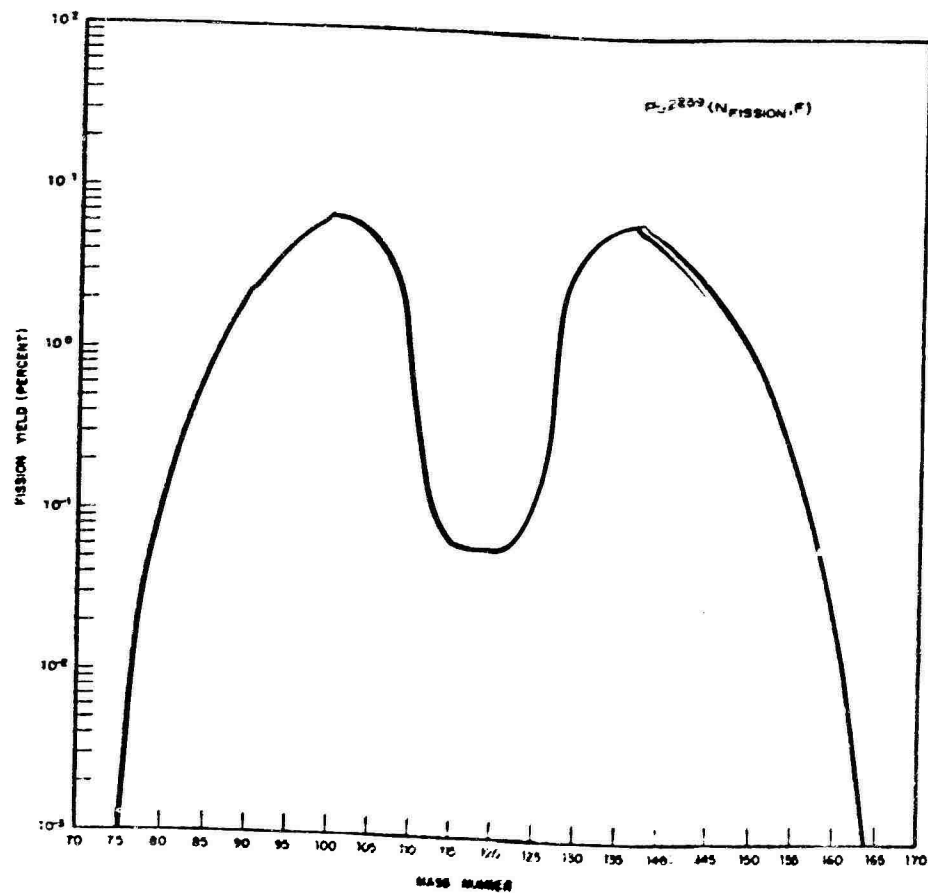


Fig. 9

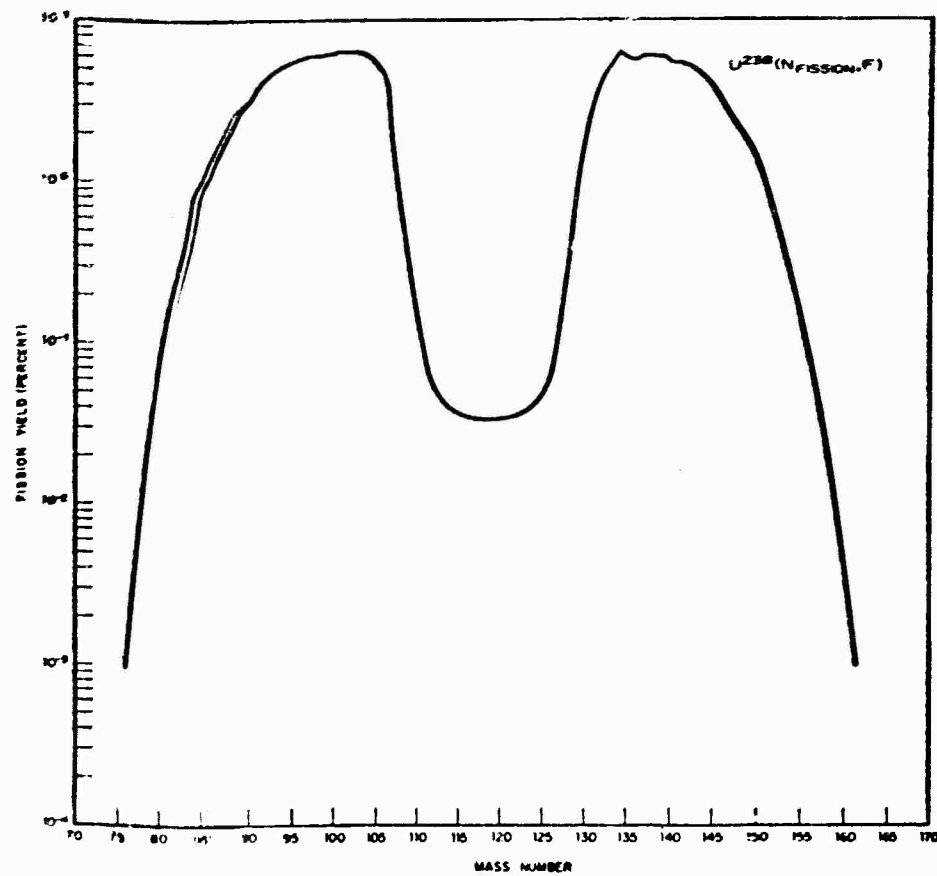


Fig. 10

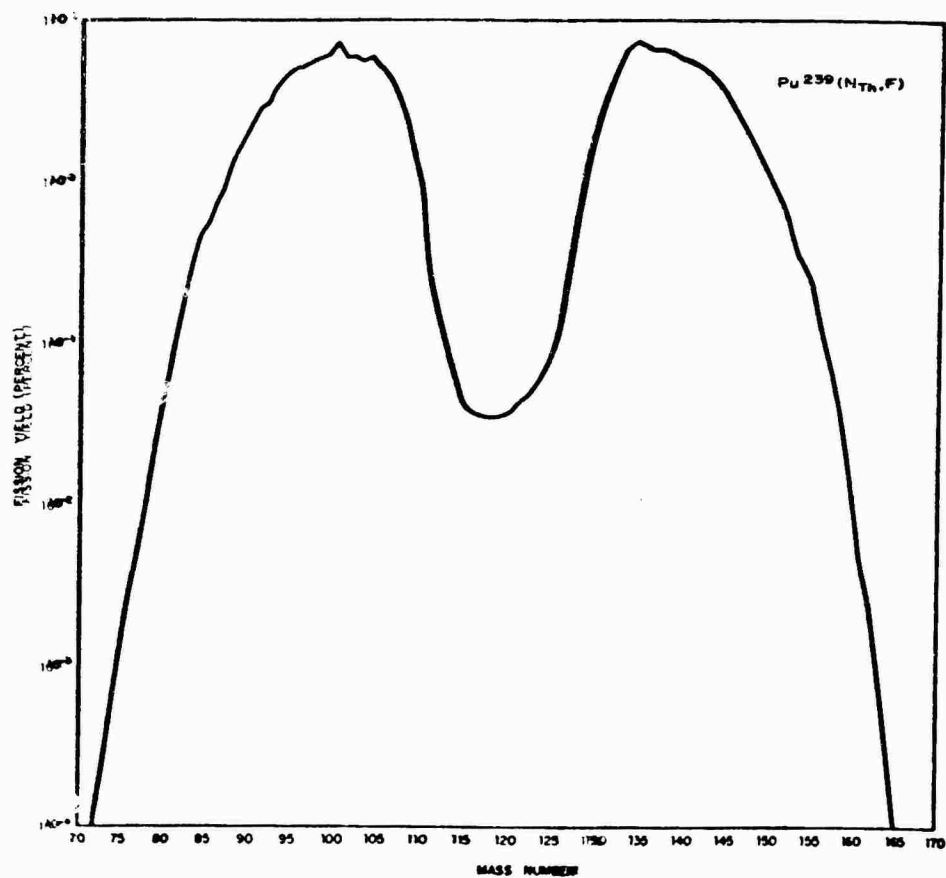


Fig. 11

[illegible]

[illegible]

MASS NUMBER	U235M	U235H	U233M	U233H	U239M	U239H	U238M	U238H	U235F1	U235F2	U238F1	U238F2	PU239F
35	-0.	0.5761	-0.	-0.	-0.	2.1196	4.81147	27.6573	-0.	-0.	3.6834	1.9697	
36	-0.	0.5761	-0.	-0.	-0.	2.1196	4.81147	27.6573	-0.	-0.	3.6834	1.9697	
37	1306.3570	54.2557	50.0392	22.3189	62.1559	82.1559	203.2769	168.1324	56.8170	241.9784	77.5353	77.5353	
38	171.0064	223.1562	153.4591	232.0550	223.7715	251.87312	223.7715	251.87312	251.87312	251.87312	251.87312	251.87312	
39	171.0064	223.1562	153.4591	232.0550	223.7715	251.87312	223.7715	251.87312	251.87312	251.87312	251.87312	251.87312	
40	22.7057	41.0626	50.0392	29.4557	0.7095	3.2532	-0.	-0.	-0.	-0.	-0.	-0.	
41	-0.	4.4024	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	
42	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
43	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
44	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
45	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
46	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
47	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
48	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
49	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
50	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
51	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
52	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
53	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
54	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
55	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
56	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623	575.7073	481.7623	575.7073	481.7623	
57	556.3906	514.2104	543.6431	547.3457	635.8494	567.7630	575.7073	481.7623					

MASS NUMBER 100									
37	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U235FI	U235FI	P239P
38	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
39	4.9920	4.9920	35.9251	13.9237	104.4083	43.9307	7.1524	1.6294	10.7284
40	11.00476	47.7525	35.9251	13.9237	104.4083	43.9307	7.1524	1.6294	10.7284
41	22.00952	105.5069	104.1145	104.1145	312.4609	197.1946	257.8704	205.6734	427.8497
42	106.0074	161.7303	180.1333	154.5943	240.6200	235.8822	105.6358	167.7550	236.5378
43	28.0112	42.0293	54.2333	78.1162	46.2732	74.1104	4.7455	21.4854	64.9326
44	-0.	-0.	46.2732	6.4553	-0.	11.2673	-0.	31.5763	44.7683
CHAIN YIELD									
0	502.6711	457.7030	440.4957	333.7605	706.0404	352.4307	533.1014	869.1564	880.1090
MASS NUMBER 101									
37	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U235FI	U235FI	P239P
38	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
39	5.0122	7.6559	22.1155	36.5488	21.6937	31.714	37.7435	2.9026	11.7176
40	17.00850	90.3812	31.5303	136.2135	161.2101	94.1248	201.3116	86.8975	288.4303
41	23.00372	105.4635	125.0376	127.9734	275.6493	244.9885	264.4343	161.0593	193.5627
42	76.0304	120.3317	90.0503	127.9734	121.4051	163.6511	89.9982	131.8326	139.4853
43	1.0706	12.5665	11.7082	29.4855	7.2346	26.9364	1.6606	15.1716	8.2940
44	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
0	502.6711	400.5993	290.8036	332.2242	587.1927	932.6522	595.4214	349.7632	674.6561
MASS NUMBER 102									
38	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U235FI	U235FI	P239P
39	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
40	5.0122	4.0479	22.0154	11.0714	2.4679	48.1478	6.7714	20.5552	1.0020
41	87.01349	45.7226	22.0154	11.0714	96.0295	48.1478	105.7334	207.1442	2.7311
42	194.00776	156.4307	87.0134	71.1543	273.6737	199.2273	234.8634	103.6391	106.5934
43	11.0044	139.1377	87.0134	100.4756	193.0340	214.4745	134.8077	103.6391	200.4924
44	14.1034	70.2362	24.0154	40.0496	34.2323	87.0134	16.9793	45.9640	31.8537
45	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
0	411.6747	378.6450	219.5537	231.5331	596.4574	516.6733	498.5613	259.4477	468.1408
MASS NUMBER 103									
38	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U235FI	U235FI	P239P
39	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
40	0.5102	23.3343	9.0383	2.0783	56.0255	20.9392	38.5339	31.9412	0.5102
41	39.0156	115.9981	55.1386	34.9117	223.9029	141.2589	126.0739	9.6731	194.5506
42	128.0312	146.0642	62.8256	79.2424	223.9029	223.9029	106.7561	59.0371	253.7942
43	22.2089	49.4925	31.6221	46.4837	56.0255	92.3968	21.9266	33.9069	63.6516
44	-0.	0.8534	1.3807	6.2145	-0.	4.1370	-0.	1.1404	-0.
0	297.6291	336.5046	179.1154	160.9278	559.6567	462.3846	442.8250	191.8542	634.6916

[illegible]

CLASS	NUMBER	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200																																																																																																																																																																									
30	-0	0.2317H	0.235HE	-0	0.1627A	0.1641I	0.1674	0.1695	0.1712	0.1729	0.1745	0.1761	0.1777	0.1793	0.1809	0.1825	0.1841	0.1857	0.1873	0.1889	0.1905	0.1921	0.1937	0.1953	0.1969	0.1985	0.1999	0.2015	0.2031	0.2047	0.2063	0.2079	0.2095	0.2111	0.2127	0.2143	0.2159	0.2175	0.2191	0.2207	0.2223	0.2239	0.2255	0.2271	0.2287	0.2303	0.2319	0.2335	0.2351	0.2367	0.2383	0.2399	0.2415	0.2431	0.2447	0.2463	0.2479	0.2495	0.2511	0.2527	0.2543	0.2559	0.2575	0.2591	0.2607	0.2623	0.2639	0.2655	0.2671	0.2687	0.2703	0.2719	0.2735	0.2751	0.2767	0.2783	0.2799	0.2815	0.2831	0.2847	0.2863	0.2879	0.2895	0.2911	0.2927	0.2943	0.2959	0.2975	0.2991	0.3007	0.3023	0.3039	0.3055	0.3071	0.3087	0.3103	0.3119	0.3135	0.3151	0.3167	0.3183	0.3199	0.3215	0.3231	0.3247	0.3263	0.3279	0.3295	0.3311	0.3327	0.3343	0.3359	0.3375	0.3391	0.3407	0.3423	0.3439	0.3455	0.3471	0.3487	0.3503	0.3519	0.3535	0.3551	0.3567	0.3583	0.3599	0.3615	0.3631	0.3647	0.3663	0.3679	0.3695	0.3711	0.3727	0.3743	0.3759	0.3775	0.3791	0.3807	0.3823	0.3839	0.3855	0.3871	0.3887	0.3903	0.3919	0.3935	0.3951	0.3967	0.3983	0.3999	0.4015	0.4031	0.4047	0.4063	0.4079	0.4095	0.4111	0.4127	0.4143	0.4159	0.4175	0.4191	0.4207	0.4223	0.4239	0.4255	0.4271	0.4287	0.4303	0.4319	0.4335	0.4351	0.4367	0.4383	0.4399	0.4415	0.4431	0.4447	0.4463	0.4479	0.4495	0.4511	0.4527	0.4543	0.4559	0.4575	0.4591	0.4607	0.4623	0.4639	0.4655	0.4671	0.4687	0.4703	0.4719	0.4735	0.4751	0.4767	0.4783	0.4799	0.4815	0.4831	0.4847	0.4863	0.4879	0.4895	0.4911	0.4927	0.4943	0.4959	0.4975	0.4991	0.5007	0.5023	0.5039	0.5055	0.5071	0.5087	0.5103	0.5119	0.5135	0.5151	0.5167	0.5183	0.5199	0.5215	0.5231	0.5247	0.5263	0.5279	0.5295	0.5311	0.5327	0.5343	0.5359	0.5375	0.5391	0.5407	0.5423	0.5439	0.5455	0.5471	0.5487	0.5503	0.5519	0.5535	0.5551	0.5567	0.5583	0.5599	0.5615	0.5631	0.5647	0.5663	0.5679	0.5695	0.5711	0.5727	0.5743	0.5759	0.5775	0.5791	0.5807	0.5823

[illegible][illegible]

MASS NUMBER 108									
40	U235TH	U235HE	U235TH	U235HE	P235TH	P235HE	U235HE	U235PI	PU235P
-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
41	0.4253	0.4772	0.4592	0.4541	18.5176	3.6584	0.6188	0.6312	18.5096
42	0.7411	0.7933	0.7219	0.7072	67.6714	48.5071	24.8747	0.6308	24.8747
43	0.7411	0.7933	0.7219	0.7072	112.6499	82.6631	42.8780	0.6308	106.5736
44	0.7443	0.8029	0.7227	0.7072	37.6774	28.4471	14.8243	0.6308	132.0641
45	-0.	1.1400	0.6181	0.6044	0.7208	0.7453	-0.	-0.	14.0990
CHAIN YIELDS									
0	7.0038	139.3117	8.3028	108.4763	285.8232	217.3811	137.8727	24.4814	20.8973
MASS NUMBER 109									
40	U235TH	U235HE	U235TH	U235HE	P235TH	P235HE	U235HE	U235PI	PU235P
-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
41	0.0982	0.5220	0.0863	0.0863	1.7017	0.2094	0.4853	0.0290	0.0465
42	0.7853	20.3963	0.5844	0.5844	28.6405	19.6178	43.8746	0.0290	4.1814
43	1.4206	57.3224	1.8913	35.3260	64.9816	67.3917	49.6438	2.0363	13.0668
44	0.6263	41.0826	1.5611	43.2045	38.1132	59.3417	14.2261	0.5576	11.2276
45	0.6453	7.8295	0.3202	13.3094	5.0950	13.0106	0.8237	5.4271	26.5104
46	-0.	-0.	-0.	0.1904	-0.	-0.	-0.	-0.	-0.
CHAIN YIELDS									
0	3.0077	126.5829	4.3054	99.3505	138.3521	189.8914	117.3584	14.8411	31.0391
MASS NUMBER 110									
41	U235TH	U235HE	U235TH	U235HE	P235TH	P235HE	U235HE	U235PI	PU235P
-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
42	0.0040	5.7869	0.1911	0.1743	7.4734	0.2537	24.1783	0.0244	0.7336
43	0.7763	42.8228	1.0308	21.8394	26.8537	43.4531	48.0521	0.6304	4.2768
44	0.6242	51.6123	1.5211	41.1735	69.8537	64.9322	24.1733	0.7589	0.3302
45	0.1240	16.2357	0.5384	85.0632	7.6734	24.9334	2.8571	5.402	8.5940
46	-0.	0.8223	0.0138	0.3081	-0.	0.8398	-0.	1.7921	0.0731
CHAIN YIELDS									
0	1.7777	119.6640	3.3551	93.6453	74.8846	146.3521	161.4187	10.9766	14.0313
MASS NUMBER 111									
41	U235TH	U235HE	U235TH	U235HE	P235TH	P235HE	U235HE	U235PI	PU235P
-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
42	0.1140	2.8138	0.3235	0.3052	0.8469	0.7624	0.1284	0.0692	0.0368
43	0.6692	24.1928	0.9783	18.452	0.1350	22.9672	40.2921	0.0692	1.3568
44	0.8233	51.7358	1.1104	41.1731	18.1373	39.1318	31.132	1.5477	1.1979
45	0.1241	24.1158	0.5384	85.0632	7.6734	24.9334	2.8571	5.402	8.5940
46	-0.	0.8223	0.0138	0.3081	-0.	0.8398	-0.	1.7921	0.0731
CHAIN YIELDS									
0	1.8002	118.0077	2.3622	96.8549	28.9638	128.0680	98.8849	7.2182	14.0313
MASS NUMBER 112									
41	U235TH	U235HE	U235TH	U235HE	P235TH	P235HE	U235HE	U235PI	PU235P
-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
42	0.0111	0.1092	0.0161	0.0161	0.0368	0.0368	0.0368	0.0368	0.0368
43	0.2021	12.1246	0.6184	27.6379	0.2533	0.8496	0.10912	0.0368	0.0368
44	0.6692	42.8228	0.9783	43.4531	0.5968	45.3295	31.5373	0.6304	1.6104
45	0.2801	41.3408	0.6455	43.4531	4.7064	31.0266	18.1374	2.7492	2.7492
46	0.0363	9.6046	0.1761	0.6087	0.8976	14.0404	0.4089	0.6011	0.6011
47	-0.	-0.	-0.	0.8087	-0.	0.1376	-0.	-0.	-0.
CHAIN YIELDS									
0	1.0008	106.8849	1.8001	93.6309	11.9346	120.9036	88.6366	6.1761	7.1366

PAGE 12

MAIN NUMBER	121	122	123	124
45	0.0000	0.0000	0.0000	0.0000
46	0.0000	0.0000	0.0000	0.0000
47	0.0000	0.0000	0.0000	0.0000
48	0.0000	0.0000	0.0000	0.0000
49	0.0000	0.0000	0.0000	0.0000
50	0.0000	0.0000	0.0000	0.0000
51	0.0000	0.0000	0.0000	0.0000
52	0.0000	0.0000	0.0000	0.0000
53	0.0000	0.0000	0.0000	0.0000
54	0.0000	0.0000	0.0000	0.0000
55	0.0000	0.0000	0.0000	0.0000
56	0.0000	0.0000	0.0000	0.0000
57	0.0000	0.0000	0.0000	0.0000
58	0.0000	0.0000	0.0000	0.0000
59	0.0000	0.0000	0.0000	0.0000
60	0.0000	0.0000	0.0000	0.0000
61	0.0000	0.0000	0.0000	0.0000
62	0.0000	0.0000	0.0000	0.0000
63	0.0000	0.0000	0.0000	0.0000
64	0.0000	0.0000	0.0000	0.0000
65	0.0000	0.0000	0.0000	0.0000
66	0.0000	0.0000	0.0000	0.0000
67	0.0000	0.0000	0.0000	0.0000
68	0.0000	0.0000	0.0000	0.0000
69	0.0000	0.0000	0.0000	0.0000
70	0.0000	0.0000	0.0000	0.0000
71	0.0000	0.0000	0.0000	0.0000
72	0.0000	0.0000	0.0000	0.0000
73	0.0000	0.0000	0.0000	0.0000
74	0.0000	0.0000	0.0000	0.0000
75	0.0000	0.0000	0.0000	0.0000
76	0.0000	0.0000	0.0000	0.0000
77	0.0000	0.0000	0.0000	0.0000
78	0.0000	0.0000	0.0000	0.0000
79	0.0000	0.0000	0.0000	0.0000
80	0.0000	0.0000	0.0000	0.0000
81	0.0000	0.0000	0.0000	0.0000
82	0.0000	0.0000	0.0000	0.0000
83	0.0000	0.0000	0.0000	0.0000
84	0.0000	0.0000	0.0000	0.0000
85	0.0000	0.0000	0.0000	0.0000
86	0.0000	0.0000	0.0000	0.0000
87	0.0000	0.0000	0.0000	0.0000
88	0.0000	0.0000	0.0000	0.0000
89	0.0000	0.0000	0.0000	0.0000
90	0.0000	0.0000	0.0000	0.0000
91	0.0000	0.0000	0.0000	0.0000
92	0.0000	0.0000	0.0000	0.0000
93	0.0000	0.0000	0.0000	0.0000
94	0.0000	0.0000	0.0000	0.0000
95	0.0000	0.0000	0.0000	0.0000
96	0.0000	0.0000	0.0000	0.0000
97	0.0000	0.0000	0.0000	0.0000
98	0.0000	0.0000	0.0000	0.0000
99	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000

PASS NUMBER 129									
44	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U236HE	U235FI	U235FI
45	-0.	-0.	-0.	-0.	-0.	-0.	8.1335	-0.	-0.
46	3.1113C	4.596C	4.596C	2.8769	15.0224	10.6729	67.0509	16.9753	6.9746
47	11.0044	52.3366	52.3366	48.3235	45.1804	71.0642	135.3016	55.3466	42.0619
48	3.08135	107.2982	107.2982	139.1977	70.2557	113.0643	73.1166	45.4476	16.4355
49	29.01116	139.1977	78.0546	109.5470	70.2557	113.0643	73.1166	45.4476	16.4355
50	6.1925	48.5926	30.0210	64.3972	16.0008	47.0024	6.9936	9.1234	24.4374
51	-0.	3.8864	1.0107	8.6409	-0.	2.1041	-0.	-0.	-0.
CHAIN YIELD3									
52	50.42351	314.5645	170.6190	233.7855	169.0715	245.5479	290.9984	126.9981	136.2324
53	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
PASS NUMBER 130									
49	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U236HE	U235FI	U235FI
50	-0.	-0.	-0.	-0.	-0.	-0.	2.2066	-0.	-0.
51	14.0073	15.2731	6.9448	0.8354	17.6137	11.0795	65.7607	13.9291	6.4309
52	7.6308	103.4316	50.2304	43.8128	92.1485	92.2324	171.1170	73.0009	49.3412
53	81.2325	187.2308	104.0729	131.0446	118.4197	140.2282	114.4094	94.4538	128.2865
54	21.7087	89.3285	44.2346	101.4589	39.8050	61.8012	18.8030	31.6302	60.5645
55	0.5322	3.6673	3.6673	19.3499	0.7563	3.6796	-0.	0.6009	4.8162
CHAIN YIELD3									
56	198.0415	358.0260	220.2942	296.5095	268.7451	299.0046	372.2989	213.6048	271.4693
57	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
PASS NUMBER 131									
46	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U236HE	U235FI	U235FI
47	-0.	-0.	-0.	-0.	-0.	-0.	0.6246	-0.	-0.
48	17.7571	7.3485	2.9120	39.3926	2.1241	56.4981	201.9579	122.0029	3.3396
49	97.6353	72.0551	64.9455	145.3401	133.4489	62.3064	201.9579	122.0029	3.3396
50	131.0224	176.2301	157.1100	135.1421	176.1369	162.6347	178.0811	163.0327	79.0144
51	46.6194	106.3316	99.1694	31.1236	77.7192	108.7619	38.6993	57.4450	142.1672
52	0.4454	12.6631	1.67103	-0.	4.6273	17.8998	-0.	1.1794	16.9026
CHAIN YIELD3									
53	273.1023	415.1764	334.8477	750.0384	374.8049	383.4999	474.0614	386.1371	246.1074
54	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
PASS NUMBER 132									
48	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U236HE	U235FI	U235FI
49	-0.	-0.	-0.	-0.	-0.	-0.	2.1388	-0.	-0.
50	8.14814	5.1318	2.1184	19.8142	1.1889	33.1418	143.2783	3.1828	17.1711
51	46.1353	56.1551	41.1384	119.7850	23.9844	13.16912	23.9844	13.16912	17.1711
52	22.0224	20.1033	17.11254	19.4274	16.1711	173.1159	42.5719	14.3361	109.3501
53	12.0486	184.6333	50.1351	78.7305	29.8537	50.4104	2.7757	-0.	-0.
54	0.7087	41.5623	50.1351	3.5219	-0.	0.5377	-0.	-0.	-0.
CHAIN YIELD3									
55	434.0232	404.0570	463.7246	410.2790	520.7585	411.6985	467.0799	503.8390	408.0440
56	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
PASS NUMBER 133									
49	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U236HE	U235FI	U235FI
50	-0.	-0.	-0.	-0.	-0.	-0.	5.6339	-0.	-0.
51	60.4804	20.2929	21.2149	1.9657	50.2536	18.0437	185.3532	56.0316	1.9550
52	162.1064	162.3873	159.1114	78.4781	244.1008	124.0089	305.4240	22.0708	70.0615
53	261.1064	241.6626	270.1891	214.8067	296.5509	224.7050	192.0092	81.0126	213.8275
54	84.4258	93.4751	118.0627	154.5943	91.6859	107.7839	28.0832	54.2531	153.7522
55	-0.	3.1899	9.1970	27.3356	1.3036	8.9591	-0.	-0.	-0.
CHAIN YIELD3									
56	650.0832	527.0179	970.5850	475.3724	684.5597	484.0923	656.8708	583.6066	672.7828
57	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.

[illegible][illegible]

Case Number	U233H	P233TH	U233E	P233TH	P233HE	U233F	U233F	U233F	U233F
32	-0	-0	-0	-0	-0	-0	-0	-0	-0
33	24,6114	3,2662	3,2667	17,6167	50,3402	48,5065	3,8291	101,6356	15,7352
34	202,5334	9,6085	114,5769	143,2976	78,6745	115,5546	250,6836	129,5426	23,5426
35	278,1116	45,5795	186,2846	283,7076	220,5733	177,5862	258,3453	168,4517	23,5417
36	112,5448	123,7313	194,6149	125,3856	159,5053	103,7060	199,5723	27,5055	11,6598
37	3,7115	18,0197	52,7259	9,9313	28,0545	-0	3,4264	32,7869	-0
38	642,5670	446,5143	446,5136	559,1733	468,9502	594,2453	659,6186	581,0816	507,5742

[illegible]

MASS NUMBER 142									
U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H
52 -0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
53 -0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
54 15.4664	15.4664	15.4664	15.4664	15.4664	15.4664	15.4664	15.4664	15.4664	15.4664
55 112.1315	112.1315	112.1315	112.1315	112.1315	112.1315	112.1315	112.1315	112.1315	112.1315
56 104.4609	104.4609	104.4609	104.4609	104.4609	104.4609	104.4609	104.4609	104.4609	104.4609
57 65.2320	65.2320	65.2320	65.2320	65.2320	65.2320	65.2320	65.2320	65.2320	65.2320
58 -0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
CHAIN VILDS									
0 601.8407	400.8023	603.1781	428.4413	497.6704	426.5908	392.6937	562.0456	690.7647	522.2662
MASS NUMBER 143									
U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H
53 -0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
54 15.4306	15.4306	15.4306	15.4306	15.4306	15.4306	15.4306	15.4306	15.4306	15.4306
55 121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604
56 171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158
57 193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742
58 124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550
59 -0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
CHAIN VILDS									
0 622.7411	476.3744	535.0358	400.4793	434.6741	390.1784	388.0240	638.2441	690.8337	484.0082
MASS NUMBER 144									
U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H
53 -0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
54 15.4215	15.4215	15.4215	15.4215	15.4215	15.4215	15.4215	15.4215	15.4215	15.4215
55 121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604
56 171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158
57 193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742
58 124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550
59 -0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
CHAIN VILDS									
0 557.3730	318.7356	458.3108	370.6475	386.4964	374.9746	328.2283	568.7896	531.4051	435.5127
MASS NUMBER 145									
U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H	U235H
53 -0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
54 15.4102	15.4102	15.4102	15.4102	15.4102	15.4102	15.4102	15.4102	15.4102	15.4102
55 121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604	121.2604
56 171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158	171.1158
57 193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742	193.1742
58 124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550	124.2550
59 -0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
CHAIN VILDS									
0 398.3061	266.0566	346.9228	317.2767	309.1482	318.4489	266.3972	406.6166	348.7832	377.0992

[illegible][illegible][illegible][illegible]

MASS NUMBER 189
 55 -0.1
 56 -0.1
 57 0.1731
 58 0.3262
 59 0.4319
 60 0.5254
 61 0.6066
 62 0.6773
 63 0.7373
 64 0.7869
 65 0.8269
 66 0.8669
 67 0.9069
 68 0.9469
 69 0.9869
 70 1.0269
 71 1.0669
 72 1.1069
 73 1.1469
 74 1.1869
 75 1.2269
 76 1.2669
 77 1.3069
 78 1.3469
 79 1.3869
 80 1.4269
 81 1.4669
 82 1.5069
 83 1.5469
 84 1.5869
 85 1.6269
 86 1.6669
 87 1.7069
 88 1.7469
 89 1.7869
 90 1.8269
 91 1.8669
 92 1.9069
 93 1.9469
 94 1.9869
 95 2.0269
 96 2.0669
 97 2.1069
 98 2.1469
 99 2.1869
 100 2.2269
 101 2.2669
 102 2.3069
 103 2.3469
 104 2.3869
 105 2.4269
 106 2.4669
 107 2.5069
 108 2.5469
 109 2.5869
 110 2.6269
 111 2.6669
 112 2.7069
 113 2.7469
 114 2.7869
 115 2.8269
 116 2.8669
 117 2.9069
 118 2.9469
 119 2.9869
 120 3.0269
 121 3.0669
 122 3.1069
 123 3.1469
 124 3.1869
 125 3.2269
 126 3.2669
 127 3.3069
 128 3.3469
 129 3.3869
 130 3.4269
 131 3.4669
 132 3.5069
 133 3.5469
 134 3.5869
 135 3.6269
 136 3.6669
 137 3.7069
 138 3.7469
 139 3.7869
 140 3.8269
 141 3.8669
 142 3.9069
 143 3.9469
 144 3.9869
 145 4.0269
 146 4.0669
 147 4.1069
 148 4.1469
 149 4.1869
 150 4.2269
 151 4.2669
 152 4.3069
 153 4.3469
 154 4.3869
 155 4.4269
 156 4.4669
 157 4.5069
 158 4.5469
 159 4.5869
 160 4.6269
 161 4.6669
 162 4.7069
 163 4.7469
 164 4.7869
 165 4.8269
 166 4.8669
 167 4.9069
 168 4.9469
 169 4.9869
 170 5.0269
 171 5.0669
 172 5.1069
 173 5.1469
 174 5.1869
 175 5.2269
 176 5.2669
 177 5.3069
 178 5.3469
 179 5.3869
 180 5.4269
 181 5.4669
 182 5.5069
 183 5.5469
 184 5.5869
 185 5.6269
 186 5.6669
 187 5.7069
 188 5.7469
 189 5.7869
 190 5.8269
 191 5.8669
 192 5.9069
 193 5.9469
 194 5.9869
 195 6.0269
 196 6.0669
 197 6.1069
 198 6.1469
 199 6.1869
 200 6.2269
 201 6.2669
 202 6.3069
 203 6.3469
 204 6.3869
 205 6.4269
 206 6.4669
 207 6.5069
 208 6.5469
 209 6.5869
 210 6.6269
 211 6.6669
 212 6.7069
 213 6.7469
 214 6.7869
 215 6.8269
 216 6.8669
 217 6.9069
 218 6.9469
 219 6.9869
 220 7.0269
 221 7.0669
 222 7.1069
 223 7.1469
 224 7.1869
 225 7.2269
 226 7.2669
 227 7.3069
 228 7.3469
 229 7.3869
 230 7.4269
 231 7.4669
 232 7.5069
 233 7.5469
 234 7.5869
 235 7.6269
 236 7.6669
 237 7.7069
 238 7.7469
 239 7.7869
 240 7.8269
 241 7.8669
 242 7.9069
 243 7.9469
 244 7.9869
 245 8.0269
 246 8.0669
 247 8.1069
 248 8.1469
 249 8.1869
 250 8.2269
 251 8.2669
 252 8.3069
 253 8.3469
 254 8.3869
 255 8.4269
 256 8.4669
 257 8.5069
 258 8.5469
 259 8.5869
 260 8.6269
 261 8.6669
 262 8.7069
 263 8.7469
 264 8.7869
 265 8.8269
 266 8.8669
 267 8.9069
 268 8.9469
 269 8.9869
 270 9.0269
 271 9.0669
 272 9.1069
 273 9.1469
 274 9.1869
 275 9.2269
 276 9.2669
 277 9.3069
 278 9.3469
 279 9.3869
 280 9.4269
 281 9.4669
 282 9.5069
 283 9.5469
 284 9.5869
 285 9.6269
 286 9.6669
 287 9.7069
 288 9.7469
 289 9.7869
 290 9.8269
 291 9.8669
 292 9.9069
 293 9.9469
 294 9.9869
 295 10.0269
 296 10.0669
 297 10.1069
 298 10.1469
 299 10.1869
 300 10.2269
 301 10.2669
 302 10.3069
 303 10.3469
 304 10.3869
 305 10.4269
 306 10.4669
 307 10.5069
 308 10.5469
 309 10.5869
 310 10.6269
 311 10.6669
 312 10.7069
 313 10.7469
 314 10.7869
 315 10.8269
 316 10.8669
 317 10.9069
 318 10.9469
 319 10.9869
 320 11.0269
 321 11.0669
 322 11.1069
 323 11.1469
 324 11.1869
 325 11.2269
 326 11.2669
 327 11.3069
 328 11.3469
 329 11.3869
 330 11.4269
 331 11.4669
 332 11.5069
 333 11.5469
 334 11.5869
 335 11.6269
 336 11.6669
 337 11.7069
 338 11.7469
 339 11.7869
 340 11.8269
 341 11.8669
 342 11.9069
 343 11.9469
 344 11.9869
 345 12.0269
 346 12.0669
 347 12.1069
 348 12.1469
 349 12.1869
 350 12.2269
 351 12.2669
 352 12.3069
 353 12.3469
 354 12.3869
 355 12.4269
 356 12.4669
 357 12.5069
 358 12.5469
 359 12.5869
 360 12.6269
 361 12.6669
 362 12.7069
 363 12.7469
 364 12.7869
 365 12.8269
 366 12.8669
 367 12.9069
 368 12.9469
 369 12.9869
 370 13.0269
 371 13.0669
 372 13.1069
 373 13.1469
 374 13.1869
 375 13.2269
 376 13.2669
 377 13.3069
 378 13.3469
 379 13.3869
 380 13.4269
 381 13.4669
 382 13.5069
 383 13.5469
 384 13.5869
 385 13.6269
 386 13.6669
 387 13.7069
 388 13.7469
 389 13.7869
 390 13.8269
 391 13.8669
 392 13.9069
 393 13.9469
 394 13.9869
 395 14.0269
 396 14.0669
 397 14.1069
 398 14.1469
 399 14.1869
 400 14.2269
 401 14.2669
 402 14.3069
 403 14.3469
 404 14.3869
 405 14.4269
 406 14.4669
 407 14.5069
 408 14.5469
 409 14.5869
 410 14.6269
 411 14.6669
 412 14.7069
 413 14.7469
 414 14.7869
 415 14.8269
 416 14.8669
 417 14.9069
 418 14.9469
 419 14.9869
 420 15.0269
 421 15.0669
 422 15.1069
 423 15.1469
 424 15.1869
 425 15.2269
 426 15.2669
 427 15.3069
 428 15.3469
 429 15.3869
 430 15.4269
 431 15.4669
 432 15.5069
 433 15.5469
 434 15.5869
 435 15.6269
 436 15.6669
 437 15.7069
 438 15.7469
 439 15.7869
 440 15.8269
 441 15.8669
 442 15.9069
 443 15.9469
 444 15.9869
 445 16.0269
 446 16.0669
 447 16.1069
 448 16.1469
 449 16.1869
 450 16.2269
 451 16.2669
 452 16.3069
 453 16.3469
 454 16.3869
 455 16.4269
 456 16.4669
 457 16.5069
 458 16.5469
 459 16.5869
 460 16.6269
 461 16.6669
 462 16.7069
 463 16.7469
 464 16.7869
 465 16.8269
 466 16.8669
 467 16.9069
 468 16.9469
 469 16.9869
 470 17.0269
 471 17.0669
 472 17.1069
 473 17.1469
 474 17.1869
 475 17.2269
 476 17.2669
 477 17.3069
 478 17.3469
 479 17.3869
 480 17.4269
 481 17.4669
 482 17.5069
 483 17.5469
 484 17.5869
 485 17.6269
 486 17.6669
 487 17.7069
 488 17.7469
 489 17.7869
 490 17.8269
 491 17.8669
 492 17.9069
 493 17.9469
 494 17.9869
 495 18.0269
 496 18.0669
 497 18.1069
 498 18.1469
 499 18.1869
 500 18.2269
 501 18.2669
 502 18.3069
 503 18.3469
 504 18.3869
 505 18.4269
 506 18.4669
 507 18.5069
 508 18.5469
 509 18.5869
 510 18.6269
 511 18.6669
 512 18.7069
 513 18.7469
 514 18.7869
 515 18.8269
 516 18.8669
 517 18.9069
 518 18.9469
 519 18.9869
 520 19.0269
 521 19.0669
 522 19.1069
 523 19.1469
 524 19.1869
 525 19.2269
 526 19.2669
 527 19.3069
 528 19.3469
 529 19.3869
 530 19.4269
 531 19.4669
 532 19.5069
 533 19.5469
 534 19.5869
 535 19.6269
 536 19.6669
 537 19.7069
 538 19.7469
 539 19.7869
 540 19.8269
 541 19.8669
 542 19.9069
 543 19.9469
 544 19.9869
 545 20.0269
 546 20.0669
 547 20.1069
 548 20.1469
 549 20.1869
 550 20.2269
 551 20.2669
 552 20.3069
 553 20.3469
 554 20.3869
 555 20.4269
 556 20.4669
 557 20.5069
 558 20.5469
 559 20.5869
 560 20.6269
 561 20.6669
 562 20.7069
 563 20.7469
 564 20.7869
 565 20.8269
 566 20.8669
 567 20.9069
 568 20.9469
 569 20.9869
 570 21.0269
 571 21.0669
 572 21.1069
 573 21.1469
 574 21.1869
 575 21.2269
 576 21.2669
 577 21.3069
 578 21.3469
 579 21.3869
 580 21.4269
 581 21.4669
 582 21.5069
 583 21.5469
 584 21.5869
 585 21.6269
 586 21.6669
 587 21.7069
 588 21.7469
 589 21.7869
 590 21.8269
 591 21.8669
 592 21.9069
 593 21.9469
 594 21.9869
 595 22.0269
 596 22.0669
 597 22.1069
 598 22.1469
 599 22.1869
 600 22.2269
 601 22.2669
 602 22.3069
 603 22.3469
 604 22.3869
 605 22.4269
 606 22.4669
 607 22.5069
 608 22.5469
 609 22.5869
 610 22.6269
 611 22.6669
 612 22.7069
 613 22.7469
 614 22.7869
 615 22.8269
 616 22.8669
 617 22.9069
 618 22.9469
 619 22.9869
 620 23.0269
 621 23.0669
 622 23.1069
 623 23.1469
 624 23.1869
 625 23.2269
 626 23.2669
 627 23.3069
 628 23.3469
 629 23.3869
 630 23.4269
 631 23.4669
 632 23.5069
 633 23.5469
 634 23.5869
 635 23.6269
 636 23.6669
 637 23.7069
 638 23.7469
 639 23.7869
 640 23.8269
 641 23.8669
 642 23.9069
 643 23.9469
 644 23.9869
 645 24.0269
 646 24.0669
 647 24.1069
 648 24.1469
 649 24.1869
 650 24.2269
 651 24.2669
 652 24.3069
 653 24.3469
 654 24.3869
 655 24.4269
 656 24.4669
 657 24.5069
 658 24.5469
 659 24.5869
 660 24.6269
 661 24.6669
 662 24.7069
 663 24.7469
 664 24.7869
 665 24.8269
 666 24.8669
 667 24.9069
 668 24.9469
 669 24.9869
 670 25.0269
 671 25.0669
 672 25.1069
 673 25.1469
 674 25.1869
 675 25.2269
 676 25.2669
 677 25.3069
 678 25.3469
 679 25.3869
 680 25.4269
 681 25.4669
 682 25.5069
 683 25.5469
 684 25.5869
 685 25.6269
 686 25.6669
 687 25.7069
 688 25.7469
 689 25.7869
 690 25.8269
 691 25.8669
 692 25.9069
 693 25.9469
 694 25.9869
 695 26.0269
 696 26.0669
 697 26.1069
 698 26.1469
 699 26.1869
 700 26.2269
 701 26.2669
 702 26.3069
 703 26.3469
 704 26.3869
 705 26.4269
 706 26.4669
 707 26.5069
 708 26.5469
 709 26.5869
 710 26.6269
 711 26.6669
 712 26.7069
 713 26.7469
 714 26.7869
 715 26.8269
 716 26.8669
 717 26.9069
 718 26.9469
 719 26.9869
 720 27.0269
 721 27.0669
 722 27.1069
 723 27.1469
 724 27.1869
 725 27.2269
 726 27.2669
 727 27.3069
 728 27.3469
 729 27.3869
 730 27.4269
 731 27.4669
 732 27.5069
 733 27.5469
 734 27.5869
 735 27.6269
 736 27.6669
 737 27.7069
 738 27.7469
 739 27.7869
 740 27.8269
 741 27.8669
 742 27.9069
 743 27.9469
 744 27.9869
 745 28.0269
 746 28.0669
 747 28.1069
 748 28.1469
 749 28.1869
 750 28.2269
 751 28.2669
 752 28.3069
 753 28.3469
 754 28.3869
 755 28.4269
 756 28.4669
 757 28.5069
 758 28.5469
 759 28.5869
 760 28.6269
 761 28.6669
 762 28.7069
 763 28.7469
 764 28.7869
 765 28.8269
 766 28.8669
 767 28.9069
 768 28.9469
 769 28.9869
 770 29.0269
 771 29.0669
 772 29.1069
 773 29.1469
 774 29.1869
 775 29.2269
 776 29.2669
 777 29.3069
 778 29.3469
 779 29.3869
 780 29.4269
 781 29.4669
 782 29.5069
 783 29.5469
 784 29.5869
 785 29.6269
 786 29.6669
 787 29.7069
 788 29.7469
 789 29.7869
 790 29.8269
 791 29.8669
 792 29.9069
 793 29.9469
 794 29.9869
 795 30.0269
 796 30.0669
 797 30.1069
 798 30.1469
 799 30.1869
 800 30.2269
 801 30.2669
 802 30.3069
 803 30.3469
 804 30.3869
 805 30.4269
 806 30.4669
 807 30.5069
 808 30.5469
 809 30.5869
 810 30.6269
 811 30.6669
 812 30.7069
 813 30.7469
 814 30.7869
 815 30.8269
 816 30.8669
 817 30.9069
 818 30.9469
 819 30.9869
 820 31.0269
 821 31.0669
 822 31.1069
 823 31.1469
 824 31.1869
 825 31.2269
 826 31.2669
 827 31.3069
 828 31.3469
 829 31.3869
 830 31.4269
 831 31.4669
 832 31.5069
 833 31.5469
 834 31.5869
 835 31.6269
 836 31.6669
 837 31.7069
 838 31.7469
 839 31.7869
 840 31.8269
 841 31.8669

PAVE IT

[illegible]

MASS NUMBER 159									
59	U233TH	U233HE	U233TH	U233HE	P239TH	P239HE	U233HE	U233FI	PU239F
60	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
61	0.0060	0.0092	0.0003	0.0003	0.0520	0.0159	0.0450	0.0226	0.0287
62	0.0525	0.0514	0.0220	0.0220	0.0874	0.0295	0.2115	0.0734	1.4923
63	0.0954	1.3436	0.0740	0.0740	1.0873	2.4474	5.3775	0.6828	3.3825
64	0.0453	1.0053	0.0671	0.0671	1.1643	0.7591	2.1181	0.1442	1.9798
65	0.0039	0.1865	0.0146	0.0146	0.1552	0.0108	0.0161	-0.	0.2650
CHAIN YIELDS									
U	0.2012	2.9981	0.1800	0.	4.2266	0.	5.6627	0.	7.2561
MASS NUMBER 159									
59	U233TH	U233HE	U233TH	U233HE	P239TH	P239HE	U233HE	U233FI	PU239F
60	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
61	0.0002	0.1463	0.	0.	0.0947	0.0947	0.0305	0.0237	0.0609
62	0.0143	0.7112	0.	0.	0.2100	0.0376	0.1208	0.0270	1.0376
63	0.0474	0.8705	0.	0.	0.3379	0.0153	0.1430	0.0150	1.0375
64	0.0075	0.2774	0.	0.	0.2100	0.	0.0340	0.0041	0.4609
65	-0.	0.0042	0.	0.	-0.	-0.	-0.	-0.	-0.
CHAIN YIELDS									
U	0.1047	2.0303	0.	0.	2.0957	0.	3.4829	0.	4.3567
MASS NUMBER 160									
60	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U235HE	U235FI	PU239F
61	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
62	0.0021	0.0206	0.	0.	0.0428	0.0356	0.0089	0.0086	0.1127
63	0.0112	0.4508	0.	0.	0.4508	0.0252	0.0074	0.1137	0.7583
64	0.0147	0.1881	0.	0.	0.1881	0.0202	0.0016	0.0029	1.1979
65	0.0049	0.0085	0.	0.	0.0085	-0.	0.0008	0.0068	0.4974
66	0.0002	-0.	0.	0.	-0.	-0.	0.0004	-0.	0.0222
CHAIN YIELDS									
U	0.0031	0.	0.	0.	0.0947	0.	2.4472	0.	2.8006
MASS NUMBER 161									
61	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U235HE	U235FI	PU239F
62	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
63	0.0001	0.0016	0.	0.	0.0016	0.	0.0032	0.0039	0.0087
64	0.0036	0.0023	0.	0.	0.1781	0.	0.0030	0.0060	0.6436
65	0.0003	0.0003	0.	0.	0.1264	0.	0.0018	0.0018	0.4809
CHAIN YIELDS									
U	0.0076	0.	0.	0.	0.0390	0.	1.6818	0.	1.4201
MASS NUMBER 162									
61	U235TH	U235HE	U235TH	U235HE	P239TH	P239HE	U235HE	U235FI	PU239F
62	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
63	0.	0.	0.	0.	0.0197	0.	0.0089	0.	0.
64	0.	0.	0.	0.	0.1950	0.	0.4805	0.	0.
65	0.	0.	0.	0.	0.1025	0.	0.3024	0.	0.
66	0.	0.	0.	0.	0.0297	0.	0.0449	0.	0.
CHAIN YIELDS									
U	0.	0.	0.	0.	0.0003	0.	-0.	0.	0.

[illegible]

Chemistry

INITIAL DISTRIBUTION

Copies

NAVY

2	Chief, Bureau of Ships (Code 240C)
1	Chief, Bureau of Ships (Code 320)
3	Chief, Bureau of Ships (Code 335)
1	Chief, Bureau of Naval Weapons (RRMA-11)
2	Chief, Bureau of Yards and Docks (Code 74)
1	Chief, Bureau of Yards and Docks (Code C-400)
1	Chief of Naval Operations (OP-07T)
1	Chief of Naval Research (Code 104)
3	Director, Naval Research Laboratory (Code 2021)
2	Director, Naval Research Laboratory (Code 6370)
1	Office of Naval Research (Code 422)
6	Office of Naval Research, FPO, New York
1	Naval Medical Research Institute (Tech Ref Library)
1	U.S. Naval Postgraduate School
1	Office of Patent Counsel, San Diego
1	U.S. Naval Hospital, San Diego

ARMY

1	Chief of Research and Development (Atomic Division)
1	Chief of Research and Development (Life Science Division)
1	Deputy Chief of Staff for Military Operations (CBR)
1	Chief of Engineers (ENCMC-EB)
1	Chief of Engineers (ENCMC-DE)
1	Chief of Engineers (ENGCW)
1	CG, Army Materiel Command (AMCRD-DE-NE)
1	CG, Ballistic Research Laboratories
1	CG, USA CBR Agency, Maryland
1	CG, CBR Combat Developments Agency, Fort McClellan
1	CO, Fort McClellan
1	Commandant, Chemical Corps Schools (Library)
1	CO, Chemical Research and Development Laboratories
1	Commander, Chemical Corps Nuclear Defense Laboratory
1	Hq., Army Environmental Hygiene Agency
1	CG, Aberdeen Proving Ground
1	Director, Walter Reed Army Medical Center
1	CG, Combat Developments Command (CDCMR-V)
1	CG, Quartermaster Res. and Eng. Command
1	Hq., Dugway Proving Ground
3	The Surgeon General (MEDNE)

1 CG, Engineer Res. and Dev. Laboratory
 1 Director, Office of Special Weapons Development
 1 CO, Office Ordnance Research
 1 CG, Mobility Command
 1 CG, Munitions Command
 1 CO, Watertown Arsenal
 1 CO, Frankford Arsenal
 1 CG, Army Missile Command

AIR FORCE

1 Assistant Chief of Staff, Intelligence (AFCIN-3B)
 6 CG, Aeronautical Systems Division (ASAPRD-NS)
 1 Directorate of Civil Engineering (AFOCE-ES)
 1 Director, USAF Project RAND
 1 Commandant, School of Aerospace Medicine, Brooks AFB
 1 Office of the Surgeon (SUP 3.1), Strategic Air Command
 1 Office of the Surgeon General
 1 CG, Special Weapons Center, Kirtland AFB
 1 Director, Air University Library, Maxwell AFB (CR-4030)
 2 Commander, Technical Training Wing, 3415th TTG
 1 Commander, Electronic Systems Division (CRZT)
 2 CO, Hq., 2D Weather Group, Langley AFB

OTHER DOD ACTIVITIES

3 Chief, Defense Atomic Support Agency (Library)
 1 Commander, FC/DASA, Sandia Base (FCDV)
 1 Commander, FC/DASA, Sandia Base (FCTG5, Library)
 1 Commander, FC/DASA, Sandia Base (FCWT)
 2 Office of Civil Defense, Washington
 2 Civil Defense Unit, Army Library
 20 Armed Services Technical Information Agency
 1 Director, Armed Forces Radiobiology Research Institute

AEC ACTIVITIES AND OTHERS

1 Research Analysis Corporation
 100 Director, Division of Biology and Medicine
 1 Aerojet General, Azusa
 1 Aerojet General, San Ramon
 1 Allis-Chalmers Manufacturing Co., Milwaukee
 1 Allis-Chalmers Manufacturing Co., Washington
 1 Allison Division - GMC
 2 Argonne Cancer Research Hospital
 10 Argonne National Laboratory
 1 Atomic Bomb Casualty Commission

1	AEC Scientific Representative, France
1	AEC Scientific Representative, Japan
3	Atomic Energy Commission, Washington
4	Atomic Energy of Canada, Limited
4	Atomics International
2	Babcock and Wilcox Company
2	Battelle Memorial Institute
1	Beryllium Corporation
1	Eorden Chemical Company
4	Brookhaven National Laboratory
1	Bureau of Mines, Albany
1	Bureau of Mines, Salt Lake City
1	Chance Vought Aircraft Corporation
1	Chicago Patent Group
1	Columbia University (Cropper)
1	Combustion Engineering, Inc.
1	Combustion Engineering, Inc. (NRD)
1	Committee on the Effects of Atomic Radiation
1	Defence Research Member
1	Denver Research Institute
1	Division of Raw Materials, Washington
1	Dow Chemical Company
3	duPont Company, Aiken
1	duPont Company, Wilmington
1	Edgerton, Germeshausen and Grier, Inc., Goleta
1	Edgerton, Germeshausen and Grier, Inc., Las Vegas
1	Fundamental Methods Association
1	General Atomic Division
2	General Dynamics, Fort Worth
2	General Electric Company, Cincinnati
4	General Electric Company, Richland
1	General Electric Company, San Jose
1	General Electric Company, St. Petersburg
1	General Scientific Corporation
1	General Telephone and Electronic Laboratories, Inc.
1	Goodyear Atomic Corporation
1	Grand Junction Office
1	Hughes Aircraft Company, Culver City
2	Iowa State University
1	Jet Propulsion Laboratory
2	Knolls Atomic Power Laboratory
2	Los Alamos Scientific Laboratory (Library)
1	Mallinckrodt Chemical Works
1	Maritime Administration
1	Martin-Marietta Corporation
1	Massachusetts Institute of Technology
1	Monsanto Chemical Company

1 Mound Laboratory
1 NASA, Lewis Research Center
2 NASA, Scientific and Technical Information Facility
1 National Bureau of Standards (Library)
1 National Bureau of Standards (Taylor)
1 National Lead Company of Ohio
1 New Brunswick Area Office
1 New York Operations Office
1 Nuclear Materials and Equipment Corporation
1 Nuclear Materials and Equipment Corporation
1 Nuclear Metals, Inc.
1 Office of Assistant General Counsel for Patents
4 Phillips Petroleum Company
1 Power Reactor Development Company
4 Pratt and Whitney Aircraft Division
1 Princeton University (White)
2 Public Health Service, Washington
1 Public Health Service, Las Vegas
1 Public Health Service, Montgomery
1 Purdue University
1 Radiation Applications, Inc.
1 Sandia Corporation, Albuquerque
1 Sandia Corporation, Livermore
1 Technical Research Group
1 Tracerlab, Inc., Richmond
3 Union Carbide Nuclear Company (ORGDP)
4 Union Carbide Nuclear Company (ORNL)
1 Union Carbide Nuclear Company (Paducah Plant)
1 United Nuclear Corporation (UNCL)
1 U.S. Geological Survey, Denver
1 U.S. Geological Survey, Menlo Park
1 U.S. Geological Survey, Naval Weapons Plant
1 U.S. Geological Survey, Washington
1 U.S. Geological Survey, WR Division
2 University of California Lawrence Radiation Lab., Berkeley
2 University of California Lawrence Radiation Lab., Livermore
1 University of California, Los Angeles
1 University of Hawaii
1 University of Puerto Rico
1 University of Rochester (Atomic Energy Project)
1 University of Utah
1 University of Washington (Donnan) (Donnan)
2 Westinghouse Bettis Atomic Power Laboratory
1 Westinghouse Electric Corporation (Rahilly)
1 Westinghouse Electric Corporation (NASA)
1 Yankee Atomic Electric Company

25 Technical Information Extension, Oak Ridge

USNRDL

40 USNRDL, Technical Information Division

DISTRIBUTION DATE: 10 May 1963

<p>Naval Radiological Defense Laboratory USNRDL-TR-633</p> <p>ESTIMATED TOTAL CHAIN AND INDEPENDENT FISSION YIELDS FOR SEVERAL NEUTRON-INDUCED FISSION PROCESSES by L. E. Weaver, P. O. Strom and P. A. Killeen 5 March 1963 46 p. tables illus. 2 refs.</p> <p>UNCLASSIFIED</p> <p>Calculated estimates are presented of unmeasured total chain yields and of independent fission yields for the fission products resulting from fission-spectrum (over)</p>	<p>1. Plutonium. 2. Uranium. 3. Radioactive isotopes. 4. Fission. 5. Fission products. 6. Neutron activation.</p> <p>I. Weaver, L. E. II. Strom, P. O. III. Killeen, P. A. IV. Title. UNCLASSIFIED</p>
<p>and 14-Mev neutron bombardment of U²³³, U²³⁵, U²³⁸ and Pu²³⁹ and from thermal neutron bombardment of U²³³, U²³⁵ and Pu²³⁹.</p> <p><u>UNCLASSIFIED</u></p>	<p>and 14-Mev neutron bombardment of U²³³, U²³⁵, U²³⁸ and Pu²³⁹ and from thermal neutron bombardment of U²³³, U²³⁵ and Pu²³⁹.</p> <p><u>UNCLASSIFIED</u></p>

<p>Naval Radiological Defense Laboratory USNRDL-TR-633</p> <p>ESTIMATED TOTAL CHAIN AND INDEPENDENT FISSION YIELDS FOR SEVERAL NEUTRON-INDUCED FISSION PROCESSES by L. E. Weaver, P. O. Strom and P. A. Killeen 5 March 1963 46 p. tables illus. 2 refs.</p> <p>UNCLASSIFIED</p> <p>Calculated estimates are presented of unmeasured total chain yields and of independent fission yields for the fission products resulting from fission-spectrum (fwd)</p> <ol style="list-style-type: none"> 1. Plutonium. 2. Uranium. 3. Radioactive isotopes. 4. Fission. 5. Fission products. 6. Neutron activation. <ol style="list-style-type: none"> I. Weaver, L. E. II. Strom, P. O. III. Killeen, P. A. IV. Title. <p>UNCLASSIFIED</p>	<p>Naval Radiological Defense Laboratory USNRDL-TR-633</p> <p>ESTIMATED TOTAL CHAIN AND INDEPENDENT FISSION YIELDS FOR SEVERAL NEUTRON-INDUCED FISSION PROCESSES by L. E. Weaver, P. O. Strom and P. A. Killeen 5 March 1963 46 p. tables illus. 2 refs.</p> <p>UNCLASSIFIED</p> <p>Calculated estimates are presented of unmeasured total chain yields and of independent fission yields for the fission products resulting from fission-spectrum (fwd)</p> <ol style="list-style-type: none"> 1. Plutonium. 2. Uranium. 3. Radioactive isotopes. 4. Fission. 5. Fission products. 6. Neutron activation. <ol style="list-style-type: none"> I. Weaver, L. E. II. Strom, P. O. III. Killeen, P. A. IV. Title. <p>UNCLASSIFIED</p>
<p>and 14-Mev neutron bombardment of U²³³, U²³⁵, U²³⁸ and Pu²³⁹ and from thermal neutron bombardment of U²³³, U²³⁵ and Pu²³⁹.</p> <p>UNCLASSIFIED</p>	<p>and 14-Mev neutron bombardment of U²³³, U²³⁵, U²³⁸ and Pu²³⁹ and from thermal neutron bombardment of U²³³, U²³⁵ and Pu²³⁹.</p> <p>UNCLASSIFIED</p>

<p>Naval Radiological Defense Laboratory USNRDL-TR-633</p> <p>ESTIMATED TOTAL CHAIN AND INDEPENDENT FISSION YIELDS FOR SEVERAL NEUTRON-INDUCED FISSION PROCESSES by L. E. Weaver, P. O. Strom and P. A. Killeen 5 March 1963 46 p. tables illus. 2 refs.</p> <p>UNCLASSIFIED</p> <p>Calculated estimates are presented of unmeasured total chain yields and of independent fission yields for the fission products resulting from fission-spectrum (over)</p> <ol style="list-style-type: none"> 1. Plutonium. 2. Uranium. 3. Radioactive isotopes. 4. Fission. 5. Fission products. 6. Neutron activation. <ol style="list-style-type: none"> I. Weaver, L. E. II. Strom, P. O. III. Killeen, P. A. IV. Title. <p>UNCLASSIFIED</p>	<p>Naval Radiological Defense Laboratory USNRDL-TR-633</p> <p>ESTIMATED TOTAL CHAIN AND INDEPENDENT FISSION YIELDS FOR SEVERAL NEUTRON-INDUCED FISSION PROCESSES by L. E. Weaver, P. C. Strom and P. A. Killeen 5 March 1963 46 p. tables illus. 2 refs.</p> <p>UNCLASSIFIED</p> <p>Calculated estimates are presented of unmeasured total chain yields and of independent fission yields for the fission products resulting from fission-spectrum (over)</p> <ol style="list-style-type: none"> 1. Plutonium. 2. Uranium. 3. Radioactive isotopes. 4. Fission. 5. Fission products. 6. Neutron activation. <ol style="list-style-type: none"> I. Weaver, L. E. II. Strom, P. O. III. Killeen, P. A. IV. Title. <p>UNCLASSIFIED</p>
<p>and 14-Mev neutron bombardment of U²³³, U²³⁵, U²³⁸ and Pu²³⁹ and from thermal neutron bombardment of U²³³, U²³⁵ and Pu²³⁹.</p> <p>UNCLASSIFIED</p>	<p>and 14-Mev neutron bombardment of U²³³, U²³⁵, U²³⁸ and Pu²³⁹ and from thermal neutron bombardment of U²³³, U²³⁵ and Pu²³⁹.</p> <p>UNCLASSIFIED</p>

<p>Naval Radiological Defense Laboratory USNRDL-TR-633</p> <p>ESTIMATED TOTAL CHAIN AND INDEPENDENT FISSION YIELDS FOR SEVERAL NEUTRON-INDUCED FISSION PROCESSES by L. E. Weaver, P. O. Strom and P. A. Killeen 5 March 1963 46 p. tables illus. 2 refs.</p> <p>UNCLASSIFIED</p> <p>Calculated estimates are presented of unmeasured total chain yields and of independent fission yields for the fission products resulting from fission-spectrum (over)</p>	<p>1. Plutonium. 2. Uranium. 3. Radioactive isotopes. 4. Fission. 5. Fission products. 6. Neutron activation.</p> <p>I. Weaver, L. E. II. Strom, P. O. III. Killeen, P. A. IV. Title. UNCLASSIFIED</p>
<p>and 14-Mev neutron bombardment of U²³³, U²³⁵, U²³⁸ and Pu²³⁹ and from thermal neutron bombardment of U²³³, U²³⁵ and Pu²³⁹.</p> <p>UNCLASSIFIED</p>	<p>and 14-Mev neutron bombardment of U²³³, U²³⁵, U²³⁸ and Pu²³⁹ and from thermal neutron bombardment of U²³³, U²³⁵ and Pu²³⁹.</p> <p>UNCLASSIFIED</p>